Underwater Bark Debris Survey
Tolstoi Log Transfer Facility
Prince of Wales Island, Alaska

Submitted to: Sealaska Timber Corporation
2030 Sea Level Dr., Suite 202
Ketchikan, AK 99901

Prepared by: Craig's Dive Center
P.O. Box 796
107 Main Street
Craig, AK 99921

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Introduction:

An underwater survey requested to determine the extent of bark debris accumulation at the Tolstoi Log Transfer Facility, Prince of Wales Island, Alaska, was performed on March 4, 1999. The purpose of the survey is to satisfy the bark monitoring program required by the NPDES permit. Permit number for the facility is AK-004784-8.

The protocol for operating a bark monitoring program is given in the LTF Siting, Construction, Operation and Monitoring/Reporting Guidelines (1985). A General Permit with slightly different protocols was issued in July 1999, but this survey was done under the provisions of the 1985 Guidelines.

Methods:

A permanent reference point location is selected, ideally in the center of the log bundle input structure. The reference point is positioned as close as possible to the exact center of the structure (regardless of type: bulkhead with A-frame, drive-down ramp, low-angle slide, etc.) and close to the estimated Mean Low Low Water (MLLW) depth to facilitate relocation for future surveys. Five transects radiate from the reference point origin at 30-degree intervals. Magnetic compass bearings are selected for the transects by referencing the transects to the center of the log transfer device. The center transect is located perpendicular to the face of a bulkhead structure, or in line with the centerline of a drive-down ramp/low-angle slide.

Each transect is sampled at 16.4-foot (5-meter) intervals starting from the origin at the permanent reference point. Debris depth measurements are made with a hand-held ruler at the sample point. The measurement is taken by vertically inserting the ruler into the debris until the natural substrate is felt or its location estimated as closely as possible. Periodically, when the confidence level in the measurement decreases due to the substrate type and/or bark amount, the bark depth is confirmed by digging by hand through the bark layer to the natural substrate. Percentage of areal coverage by bark debris is determined by using the ruler, which is randomly dropped at the sample point, as the base of a visually estimated 3.3-foot (1-meter) square. The percent cover is objectively estimated by the amount of bark cover within that square.

Sample points are established along a transect until a water depth of 60 feet MLLW is reached or the measured bark debris depth becomes insignificant. At each sample point several data are recorded by the diver: water depth; debris depth; percent coverage of debris; debris composition and character; substrate type; species abundance, condition and diversity; direction and strength of current; visibility; and the presence of any significant operational debris. Transects are identified by their magnetic compass headings.

Photographs are taken of representative sample points to document substrate, bark debris, algal and animal life, and any other debris/objects that may be of concern. Water depth measurements are taken from a Suunto dive computer with an accuracy of +/- 1%. A

Suunto compass is used to navigate the transect compass headings and is attached to a 4-foot measuring ruler.

The field data are analyzed to meet the criteria of the survey intent. The total survey surface area calculation is made by taking the triangle formed by two adjacent transects and using the transect with the most sample points (longest distance) as the base leg of a right triangle area calculation. The total square footage of the debris field area is a summation of these four triangle areas. This figure is converted to acres as required by the guidelines. To determine the areal extent of 100 % bark cover, the percentage of sample points with 100 % coverage is calculated and multiplied by the total sample area to derive the areal extent in acres of 100 % bark cover.

Results:

Weather conditions at survey time were mostly cloudy to overcast skies, with light and variable winds and light snow showers; air temperature was in the thirties. The diving started at 0940 and ended at 1145, taking place during a flooding tide cycle. Low tide occurred at 0759 with a height of 0.4 feet (corrected to subordinate station # 1497, Hadley, Lyman Anchorage, from the Ketchikan reference station) and a tidal range of 16.1 feet. No noticeable current was present during the survey dive. Water temperature was measured at 44 degrees. Underwater visibility was estimated to be 40 feet.

A total of 55 sample points were taken on the five transects, and all sample points had some bark debris. Of these, 34 (62 %) had 100 % bark cover. Twenty-eight sample points (51 %) had 100 % cover and a bark depth of ten centimeters or greater. The total area covered by the dive survey was 1.1 acres. The area covered by 100 % bark cover was 0.68 acres. The area covered by 100 % bark cover and a bark depth of at least 10 centimeters was 0.46 acres.

Bark Deposition Summary		
Total Survey Area	Area with 100 % Bark Cover	Area with 100 % Cover & Debris Depth > 10 cm
1.1 Acres	0.68 Acres	0.46 Acres

Observations:

The LTF is located on the southern shoreline of a small bay within the larger Tolstoi Bay. The intertidal substrate is a mix of rocks, gravel and sand, with outcroppings of bedrock on either side of the drive-down ramp. The subtidal substrate is mostly sand, except for the areas of bedrock reefs. The grade of the slope is steeper on the westerly transects and more moderate on the easterly transects. A prominent bedrock reef, located a short distance to the east of the drive-down ramp, projects nearly perpendicularly out from shore and extends down to the maximum depths of the survey. Transects 020 and 050 cross over this reef. After several years of surveying this site, it is apparent that this

bedrock reef both affects the tidal current flowing parallel to shore, and blocks much of the bark dispersal to the east.

The zone of deposit covers the entire dive survey area, though it is broken up by the reef system. The bark depth measurement data show a decreasing trend towards the ends of the transects, with the majority of bark accumulation on and surrounding the fill rock structure of the ramp. Character and size of the observed bark debris varied, depending on where it was located within the survey area. Debris along transects 020 and 050 tended to be very small in size, characterized as bark dust, with few to no bark chips. The area of transects 290 to 350 tended to be dominated by larger debris sizes, predominantly as bark chips and bark chunks to small wood pieces. A few, scattered sunken logs were noted during the dive. Where the bark depth was greater than approximately 25 centimeters, the bark mass exhibited a "jiggling" when the measuring ruler was inserted into the debris.

My impression of the survey area is that the marine life observed appears to be generally healthy and is not being adversely affected by the bark debris, other than the smothering effect on benthic infauna when bark accumulation reaches a depth of approximately ten centimeters or more. Habitat types were probably that typical of a rocky, solid substrate (on the rocky reef area) and one associated with a sand substrate before the facility was operated. The marine life community present now is one typical of a community commonly found on a bark-dominated substrate, except for the exposed bedrock upon which the bark cannot accumulate. On the basis of my experience, it appears that the transition to a bark-dominated substrate is followed by a community shift. Species composition changes from what were there originally, but the bark-dominated community can comprise an abundant level of certain taxa, particularly crustaceans.

Little plant life was observed anywhere in the survey area, which is typical of the late winter survey time. Green algae species were present in small amounts in the intertidal to subtidal zone, mainly on top of the drive-down ramp. Subtidally, the large-bladed Laminarians were present infrequently. On the bedrock surfaces, two unidentified species of foliose red algae were noted, along with crustose red algae.

Few anemones were observed, probably due to the lack of solid substrate for attachment. The white anemone *Metridium sp.* was present occasionally throughout the area, attached to larger debris pieces or rock. On the bedrock reef were unidentified species of an encrusting sponge, as well as plumose hydroid species. Another anemone species, *Pachycerianthus fimbratus,* was present in low numbers where the bark depth was about 10 centimeters or less over sand substrate.

A few bivalve siphons were observed above the substrate/bark surface. The identified siphons were that of *Tresus nuttalli,* with one other siphon remaining unidentified. A gastropod mollusk, *Polinices lewisii,* observed in low numbers crawling on the surface of the debris, was a possible indicator of a hidden bivalve population: bivalve clams are the prey of *P. lewisii* and must be present in sufficient numbers to support the predatory mollusks. Intact egg cases of *P. lewisii* were observed. Feces of the wood-boring clam

Bankia setacea bordered any large piece of wood or log. Another unidentified mollusk, present in low diversity and abundance, were the opisthobranchs (nudibranchs). Low to moderate numbers of *Pododesmus cepio* were attached to the rock reef surfaces. Small numbers of the scallop *Chlamys sp.* were observed over the entire survey area.

Echinoderm abundance and diversity in the area was moderate. Sea star species observed were *Pycnopodia helianthoides, Crossaster papposus,* and *Evasterias troschelii.* Unidentified brittle star species were on the surface of the bark debris in low numbers. Two species of sea urchins, with only a few individuals each, were present: *Strongylocentrotus droebachiensis* and *S. franciscanus*. Confined within a narrow depth zone were moderate numbers of *Parastichopus californicus*.

Crustacean abundance and diversity was also moderate. Shrimp of undetermined species were observed using small rocks or bark chips for crevice habitat over the entire area. Small crabs of the Majidae family (decorator crab), commonly observed at LTFs on the bark and natural substrate, were present in high abundance. Most of these crabs were using bark pieces to "decorate" their shell, instead of the more commonly used algae or pieces of other invertebrates. Hermit crab abundance and diversity was also moderate.

Other miscellaneous invertebrate species present were the tunicates *Corella willmeriana* and *Halocynthia aurantia* and an unidentified flatworm.

A few species of fish were observed and all were low in abundance. Small flatfish of undetermined species were present at all depths in low numbers. The family Cottidae, the sculpins, was represented by two or three species in moderate numbers. Both female and male *Hexagrammos decagrammus* were noted during the dives.

No significant manmade debris was observed in the survey area, other than the typical amounts of banding wire, scattered tires, and other minor operational debris.

If there are any questions regarding this report, please contact me at 826-3481. Thank you for allowing Craig's Dive Center to be of service.

Respectfully submitted,

Craig Sempert

TABLE 1
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (cm)	Percent Coverage	Substrate Type
Ref. Pt.	3	10	50	Sa, Rk
290/1	7	25	100	Rk
290/2	18	30	100	Rk
290/3	29	56	100	Rk
290/4	34	33	100	Sa
290/5	38	30	100	Sa
290/6	42	23	100	Sa
290/7	45	15	100	Sa
290/8	51	13	100	Sa
290/9	54	8	100	Sa
290/10	58	5	100	Sa, Sh
320/1	10	5	100	Rk, Sa
320/2	20	30	100	Rk
320/3	30	64	100	Rk
320/4	40	33	100	Sa
320/5	45	18	100	Sa
320/6	51	15	100	Sa
320/7	59	8	100	Sa
350/1	10	5	75	Gr, Rk, Sa
350/2	20	20	100	Rk
350/3	28	61	100	Sa
350/4	37	36	100	Sa
350/5	41	20	100	Sa
350/6	47	13	100	Sa
350/7	49	10	75	Sa, Rk
350/8	47	8	100	Rk, Brk
350/9	48	5	50	Brk
350/10	54	8	25	Brk
350/11	65	8	90	Rk, Sa

TABLE 1 (cont.)
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (cm)	Percent Coverage	Substrate Type
020/1	10	5	50	Gr, Rk
020/2	15	5	75	Gr, Rk
020/3	25	25	100	Sa
020/4	27	51	100	Sa
020/5	27	20	100	Sa
020/6	25	5	75	Sa
020/7	29	23	100	Rk, Sa
020/8	28	3	50	Brk
020/9	36	18	100	Sa
020/10	39	10	100	Sa
020/11	43	8	100	Sa
020/12	45	3	50	Sa, Rk
020/13	51	3	50	Sa, Rk
020/14	57	5	50	Sa, Rk
050/1	9	<3	25	Gr, Rk
050/2	11	<3	25	Gr, Rk
050/3	18	28	100	Sa, Gr, Sh
050/4	17	30	100	Sa, Sh
050/5	17	43	100	Sa, Sh
050/6	7	T	T	Brk
050/7	5	T	T	Brk
050/8	15	3	75	Sa, Rk
050/9	18	5	100	Sa, Sh
050/10	22	10	100	Sa, Sh
050/11	27	5	75	Sa, Sh
050/12	32	3	75	Sa, Sh

Key to Substrate Type	
Brk	Bedrock
Gr	Gravel
Rk	Rock
Sa	Sand
Sh	Shell
Si	Silt

Table 2

Species Abundance

L = Low C = Common A = Abundant

Scientific Name	Common Name	Abundance
Plants		
Ulva/Monostroma spp.	Sea Lettuce	L
Unidentified Rhodophyta spp.	Crustose red algae	L
Unidentified Rhodophyta spp.	Foliose red algae	L
Laminaria spp.	Kelp	L
Invertebrates		
Metridium sp.	Anemone	C
Unidentified Hydroid spp.	Plumose hydroid	L
Unidentified Porifera spp.	Sponge	L
Pachycerianthus fimbratus	Tube anemone	L
Unidentified Polyclad spp.	Flatworm	L
Tresus nuttallii	Horse neck clam	L
Chlamys spp.	Scallop	L
Polinices lewisii	Moon snail	L
Bankia setacea	Shipworm	C
Pododesmus macrochisma	Jingle	L
Flabellina spp.	Nudibranch	L
Parastichopus californicus	Sea cucumber	C
Strongylocentrotus droebachiensis	Green urchin	L
Strongylocentrotus franciscanus	Red urchin	
Pycnopodia helianthoides	Sunflower star	C
Crossaster papposus	Rose star	L
Evasterias troschelii	False ochre star	L
Unidentified Ophiuroidea spp.	Brittle star	L
Balanus sp.	Barnacle	L
Pandalus spp.	Shrimp	C
Pagurus spp.	Hermit crab	C
Oregonia gracilis	Graceful decorator crab	C
Unidentified Bryozoan spp.	Moss animal	L
Halocynthia aurantia	Sea Peach	L
Corella willmeriana	Solitary tunicate	L
Vertebrates		
Hexagrammos decagrammus	Kelp greenling	L
Unidentified fish	Flatfish	L
Unidentified Cottidae spp.	Sculpins	L